ENERGY AT RECEIVER.

The energy of the tone at the mouth of the receiving resonator is proportional to the square of the amplitude of vibration of the sensitive plate. And since this plate carries one of the refractometer mirrors its amplitude can be expressed in terms of wave-lengths of monochromatic (sodium) light. In short, an expression for relative intensity will be:

$$\left(\frac{B \tan \alpha}{w}\right)^2$$

when B is the double amplitude due to the motion of object glass, α is the slope of the fringes due to tone, and w is the width of a double fringe. This relative measure can be reduced to absolute measure in a manner differing from that employed by Wien* only in the fact that the energy of the little mirror is taken account of and the identical resonator in the identical position, but with plate of high pitch, is used to calebrate the sensitive arrangement in absolute units.

This combination of source and receiver seems exceptionally well adapted to the investigation of such problems as the variation of the intensity of sound with distance, the viscosity of the air, sound shadows, reflection of sound from various substances, refraction of sound in various media, the distribution of sound in a room, with the natural pitch and damping (echo) of a room, intensity of the minimum sound audible, test of Weber's Law,† etc.

The elaboration of the instrument has left, thus far, no opportunity for systematic research. Some results of interest have been obtained, such as tests for constancy and sensitiveness, photographs of vowel and other sounds; but these results are fragmentary, and have been of value chiefly to serve the purpose of tests, and of suggestion to further improvements in means or method. In the near future some acoustical problems will be attacked in the laboratory of Clark University, and the results, as well as a fuller account of instruments and method, will be published, it is planned, jointly by Professor Webster and myself.

BENJAMIN F. SHARPE.

GREENWICH, N. Y., June, 1899.

*Wied. Ann., 1889, p. 834.

†Fechner, 'Hauptpuncte der Psychophysik,' p. 185.

NEW YORK STATE SCIENCE TEACHERS ASSOCIATION.

THE third annual meeting was held at the Teachers College of Columbia University, December 29 and 30, 1898, affording to the members of the Association an opportunity to attend most of the meetings of the Society of Naturalists.

Dr. Charles B. Davenport, of Harvard University, read a paper on zoology as a condition for admission to college. He favored the study of animals by the laboratory method as outlined in the Harvard requirements, and thought that too much attention was being given to dissection in most secondary schools. He encouraged the study of economic zoology in a preparatory course, leaving most of the dissection to be done in the college.

The first afternoon was devoted to the report of the Committee of Nine, by Dr. Le Roy C. Cooley, after which the Association attended the annual discussion of the Society of Naturalists on 'Advances in Methods of Teaching.' In the evening the President, Dr. Charles W. Hargitt, delivered the annual address, on 'Science and the New Education,' in which he defined the relation of science to the other elements of the modern curriculum. The address was followed by a most enjoyable reception by the Trustees of Teachers College.

The second day began with four simultaneous section meetings. Section A, Biology, in charge of Dr. Charles L. Bristol,

discussed three papers: Professor George F. Atkinson, on 'Entrance Requirements for the University in Botany and Zoology'; Professor James E. Peabody, on 'Physiology in the High School,' and Miss Idelette Carpenter on 'The Teaching of Botany in the Girls High School of New York.'

Section B, Earth Science, conducted by Professor Richard E. Dodge, considered papers by the Chairman, by Mr. E. W. Sampson and by Miss L. Belle Sage. Section C, Nature Study, in charge of Mr. Charles B. Scott, attracted a larger number of teachers than any other, and presented too many papers to be mentioned in detail in this report. The discussions dealt principally with the aims of nature study, the materials for study, and plans for helping teachers. An excellent report of this section appears in the February number of *New York Education* (Albany). Section D, Physics and Chemistry, conducted by Professor Albert L. Arey, discussed these sciences from the point of view of the secondary schools, the colleges and the Regents. Professor Edwin H. Hall, of Harvard University, Dr. William Hallock, Dr. Edward L. Nichols, Professor Frank Rollins, Mr. Charles N. Cobb and Professor Irving P. Bishop presented papers.

Following the Section meetings Dr. C. F. Hodge, of Clark University, spoke on 'The Active Method in Nature Study.' Mr. Arthur G. Clement read a paper on 'The Use of the Microscope in Secondary Schools.' At the last session, which was held in the American Museum of Natural History, Mr. Frank M. Chapman gave an illustrated lecture on 'The Educational Value of Bird Study.'

The Association cordially endorsed the report of the Committee of Nine, and asked a continuation of their work for another year. Resolutions were adopted in favor of one year of physical science, one of biological science and one of earth science in all the secondary schools of the State, and steps were taken toward the recommendation of subject-matter and effective methods in each of these branches. It was also resolved "That any physical, biological or earth science which has been pursued consecutively for one full year, by the approved class-room and laboratory methods, and which has stood the approved tests for quality, should be accepted by the colleges for admission to their freshman classes."

Authority was given to a committee of five "to ascertain and report what is definitely known regarding the physiological effects of alcohol and narcotics on the human body, and to recommend suitable methods for teaching the same in the schools of this State."

The sessions were well attended and the character of the papers and discussions was a sufficient evidence of the interest that centers in the Association and its work. The Teachers College provided amply for all the wants of the visitors and made their stay in the city comfortable as well as profitable.

A complete report of the meetings will be published by the Regents and may be obtained by applying to the Secretary of the Association.

The next meeting will be held at Syracuse during the Christmas holidays.

The following officers were chosen for 1899: President, Le Roy C. Cooley, Vassar College, Poughkeepsie. Vice-President, Albert L. Arey, Rochester Free Academy, Rochester. Secretary and Treasurer, James E. Peabody, The High School, 3080 Third Avenue, New York City. Executive Council, Mr. Charles N. Cobb, Regents Office, Albany; Dr. Franklin W. Barrows, Central High School, Buffalo; Professor J. H. Comstock, Cornell University, Ithaca; Professor William Hallock, Columbia University, New York; Miss Mary E. Dann, Girls High School, Brooklyn; Professor D. L.

Bardwell, State Normal School, Cortland; Dr. Charles W. Dodge, University of Rochester; Principal Thomas B. Lovell, High School, Niagara Falls; Professor, W. C. Peckham, Adelphi College, Brooklyn; Professor J. McKeen Cattell, Columbia University, New York; Professor John F. Woodhull, Teachers College, New York; Professor E. R. Whitney, High School, Binghamton.

FRANKLIN W. BARROWS.

SCIENTIFIC BOOKS.

Urkunden zur Geschichte der nichteuklidischen Geometrie. Von F. ENGEL und P. STAECKEL. *I. Nikolai Ivanovitsch Lobatschefski.* Leipzig, B. G. Teubner. 1899. 8vo. Pp. 476.

The name of Lobachévski is inseparably connected with a scientific advance so fundamental as actually to have changed the accepted conception of the universe.

Yet his first published work and his greatest work have both remained for over sixty years inaccessible, locked up in Russian, and are now for the first time given to the world in this monumental volume by Professor Engel.

As to the precise time at which Lobachévski shook himself free from Euclid's two thousand years of authority there is still room for a most interesting doubt.

The first of the two treatises given in this book, 'On the Elements of Geometry,' was published in 1829, with this note at the foot of the first page:

"Extracted by the author himself from a paper which he read February 12, 1826, in the meeting of the Section for Physico-mathematic Sciences, with the title: 'Exposition succincte des principes de la Géométrie, etc.'"

Again, when the four equations are reached which really contain the essence of the non-Euclidean geometry, Lobachévski subjoins this note: "The equations (17) and all that follows these the author had already appended to the paper which he presented in 1826 to the Section for Physico-mathematic Sciences."

In the introduction to the second of the two treatises here given, the 'New Elements of Geometry,' the author says: "Everyone knows that in geometry the theory of parallels has remained, even to the present day, incomplete.

"The futility of the efforts which have been made since Euclid's time during the lapse of two thousand years to perfect it awoke in me the suspicion that the ideas employed might not contain the truth sought to be demonstrated, and for whose verification, as with other natural laws, only experiments could serve, as, for example, astronomic observations.

"When, finally, I had convinced myself of the correctness of my supposition, and believed myself to have completely solved the difficult question, I wrote a paper on it in the year 1826, 'Exposition succincte des principes de la Géométrie, *avec une démonstration rigoureuse du théorème des parallèles*,' read February 12, 1826, in the séance of the physico-mathematic Faculty of the University of Kazan, but never printed." No part of this French manuscript has ever been found. The latter half of the title is ominous.

For centuries the world had been deluged with rigorous demonstrations of the theorem of parallels. We know that three years later Lobachévski himself proved it absolutely indemonstrable.

Yet the paper said to contain material to stop forever this twenty-centuries-old striving still was headed 'démonstration rigoureuse,' just as Saccheri's book of 1733 containing a coherent treatise on non-Euclidean geometry ended by one more pitiful proof of the parallel-postulate.

If Saccheri had lived three years longer and realized the pearl in his net, with the new meaning, he could have retained his old title: 'Euclides ab omni naevo vindicatus,' since the non-Euclidean geometry is a perfect vindication and explanation of Euclid. But Lobachévski's title is made wholly indefensible.

A new geometry, founded on the contradictory opposite of the theorem of parallels, and so proving every demonstration of that theorem fallacious, could not very well pose under Lobachévski's old title. Least said, soonest mended. He never tells what he meant by it, never tries to explain it.

Yet Engel thinks that under this two thousand years stale title, 'avec une démonstration